1.23 Uncertainty

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Environmental appraisal presents deeper and wider problems than are typically conceded in policy. Strong political pressures for decision justification routinely force the closing down of due deliberation over the real limits to knowledge. Even technical language can become warped – to imply that all environmental dilemmas are susceptible to apparently precise and definitive probabilistic risk analysis. The inconvenient messiness of less tractable aspects of incertitude (strict uncertainty, ambiguity and ignorance) can thereby be suppressed. Reviewing the most serious problems, this chapter outlines practical methods for resisting these pressures and opening up a more rigorous, robust, transparent – and democratically accountable – environmental politics.

Threats to climate, biodiversity, soils, air and water join longstanding issues of poverty and vulnerability in demanding urgent action. Radical transformations are required in global institutions and infrastructures for provision of energy, food, water, mobility and livelihoods. So, political, economic and social – as well as environmental – stakes are high. Yet, it is rarely the case that all details of the issues in question can be definitively pinned down (Gee et al. 2013). There usually remains significant scope for questions over: appropriate knowledges; causal processes; possible implications; and relevant actions. These are the dilemmas of what is often ambiguously called 'uncertainty' – but more accurately described as 'incertitude' (Harremoës et al. 2001). As we will see, specialist usages of 'uncertainty' can elide crucially different features of context – allowing irresponsible "pretence of knowledge" (Hayek 1978). An overarching term like 'incertitude' helps avoid this.

Whatever it is called, what makes incertitude more tricky are the political realities in which it is set. Despite the value of high quality evidence and analysis, even the best available policy-relevant science is prone to delivering divergent pictures of salient problems and solutions – for instance in energy (Sundqvist et al. 2004), chemicals (Saltelli et al. 2008), biotechnology (Stirling & Mayer 2001) and industrial safety (Amendola 2001). Indeed, the levels of incertitude associated with a relevant peer-reviewed literature are (when attended to) often sufficient to support many contrasting possible courses of action (Funtowicz & Ravetz 1990). The most important feature of 'sound science' or 'evidence based policy', then, is that these disciplines are rarely adequate, definitely to justify any single particular intervention. In other words, dilemmas of incertitude typically mean that no particular policy

can be uniquely validated by the available evidence. The idea of a single 'evidence based policy' is an oxymoron.

Sadly, these challenges are seriously neglected – sometimes even denied – in mainstream environmental policy. This can be seen even in a field where 'science based' comparative appraisal methods are arguably at their most sophisticated and mature: in the energy sector. This is an area where climate change as well as many other environmental issues present some of their most formidable policy challenges. So, an impressive range of techniques address questions over which energy strategy looks on balance most favourable. Focusing on results expressed as monetary 'environmental externalities', Figure 1 (below) summarises a problem that is also common to environmental risk assessment, multicriteria appraisal or life cycle analysis (Stirling 2010). Shown on the right, is the number of peer-reviewed studies for each energy option (all with results cited in official regulatory interventions). Particular findings of one indicative study are shown in grey. Results obtained in the entire literature are shown as black bars, the thickest parts of which give the range for the central half of all studies.

Figure 1: *Neglected variability in environmental appraisal – the example of energy assessments* (graphic adapted from (Sundqvist et al. 2004))

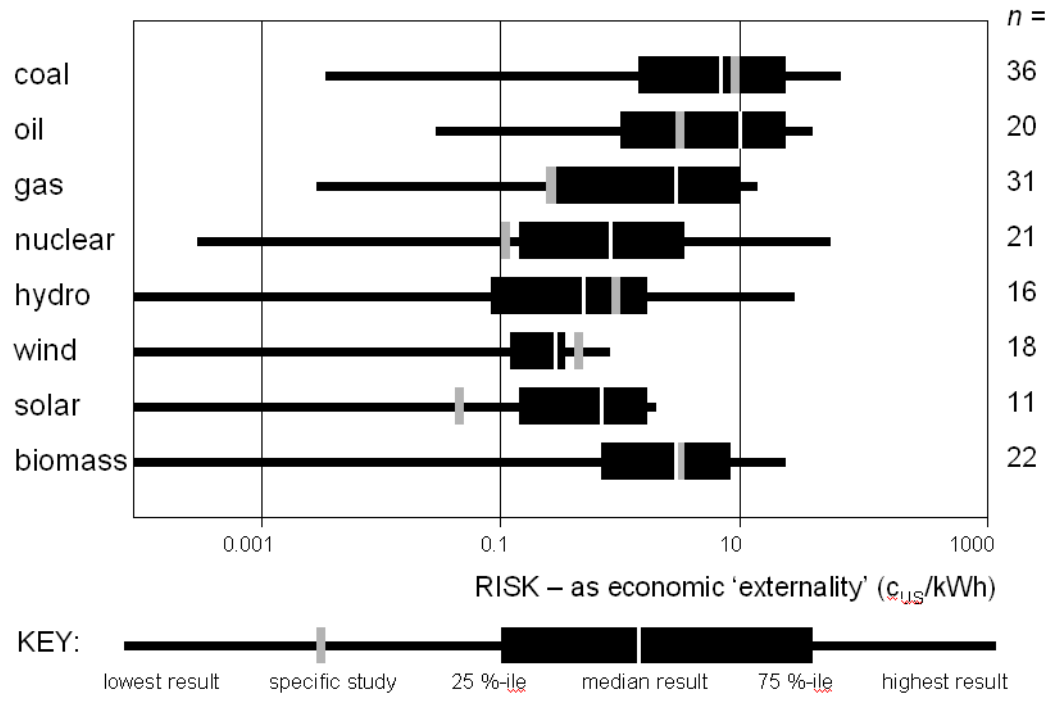


Figure 1 shows that the incertitude expressed in an individual study of comparative environmental implications of different policies, tends to be very small compared to the corresponding range in the relevant peer-reviewed literature as a whole. So policy debates informed by just a subset of studies, typically only get a partial impression of the issues at stake. It is therefore routinely possible to justify on grounds of selected studies, any one among many different policy choices. And what is true in the field of energy policy, also applies in other areas of environmental governance – like agriculture, transport, or water. In interactions between different sectors, dilemmas of incertitude are correspondingly amplified.

Policy challenges are even further compounded, when it is taken into account how pressures for closure in the 'real world' of policy making conflict with actual levels of incertitude in the 'real real world' of natural environments and societies themselves. The open-endedness of policy choices illustrated in Figure 1 is an unavoidable reflection of complex environmental realities. Just as a simple object looks different from contrasting angles, so pictures of complex environmental challenges and solutions differ even more radically, depending how they are 'framed'.

Figure 2 summarises a range of dimensions under which analysis can be framed differently – but equally rigorously and legitimately – such as to yield radically distinctive answers. These resulting diversities are seriously inconvenient in high stakes political processes, in which policy actors are incentivised to represent their favoured arguments in exaggeratedly precise and determinate ways. Acknowledgements of incertitude are typically held to weaken political justification. So strong pressures are experienced by analysts and academics to perform various artificial kinds of analytical closure (Stirling 2010). This is why challenges of incertitude remain neglected – and typically large ranges of variability like those shown in Figure 1 are frequently ignored.

Figure 2: *Examples of different kind of framing assumptions implicated in environmental incertitude*

Equally relevant to quantitative and qualitative approaches

setting agendas	defining problems	posing questions
prioritising issues	deciding context	choosing methods
addressing power	definition of options	selecting alternatives
handling dissensus	designing process	drawing boundaries

More relevant to expert and calculative approaches

discounting time	formulating criteria	characterising metrics
setting baselines	deriving probabilities	including disciplines
expressing uncertainties	recruiting expertise	commissioning research
constituting proof	exploring sensitivities	interpreting results

More relevant to participatory and discursive approaches

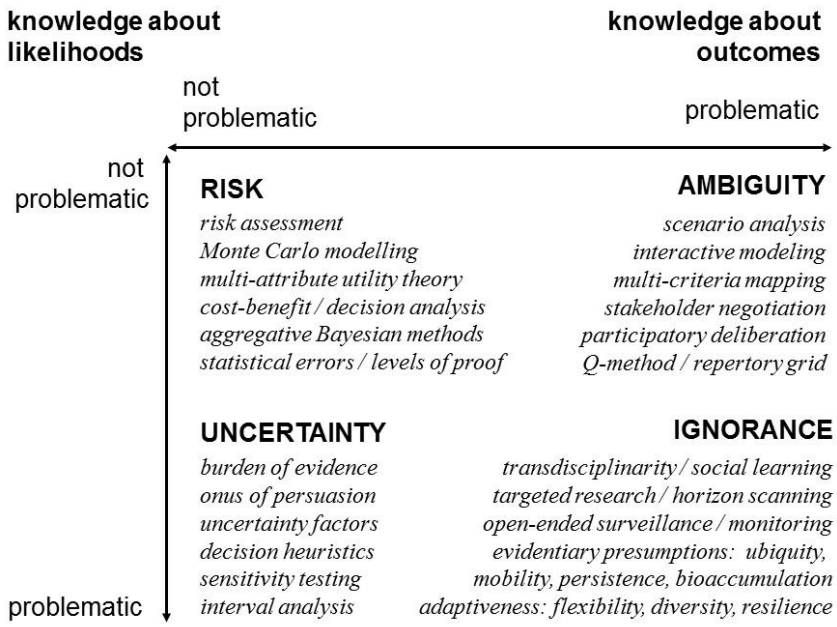
identifying stakeholders	phrasing questions	bounding remits
recruiting participants	providing information	focusing attention
engaging personalities	conducting discourse	facilitating interactions
documenting findings	persuading critics	adopting norms

Contrasting responses to incertitude

What can be done about these formidable challenges of incertitude in environmental governance? Although there are no panaceas, there exist many practical responses. Like incertitude itself, many of these also remain neglected. In limited space, only an indicative sample can be covered here. For a start, there is the language of environmental appraisal. Terms like 'risk', 'uncertainty', 'ambiguity' and 'ignorance' are bandied around in many diverse ways in this field. It is not realistic or useful to try to assert only one kind of usage. But what is essential in interests of effective decisions, is to resist instrumental pressures to use such words in ways that systematically exaggerate the tractability of incertitude.

Why this matters, is summarised in Figure 3. Long central to environmental appraisal (EPA 1998)(UK_Department_of_Environment 1995)(Suter 2006), the word 'risk' has for more than a century referred to a condition under which there is confidence that problematic knowledge can satisfactorily be addressed by assigning probabilities to reflect perceived relative *likelihoods* for each of a defined range of possible *outcomes* (NRC 1983)(PCCRARM 1997)(Byrd & Cothern 2000). Accordingly, the dimensions of Figure 3 represent confidence in the quality of knowledge experienced under each of these twin constituting parameters of risk: probability and outcomes (Stirling 2010). In opening up these dimensions, a range of complementary methods become visible beyond risk assessment.

Figure 3: *Different aspects of incertitude, as distinguished in relation to two dimensions of knowledge* (adapted from (Stirling 2010))



For a century or so, economists have explicitly contrasted a strict definition of 'uncertainty' with the state of 'risk' – uncertainty in these terms being a condition under which there *cannot* be confidence in any single representation of probabilities (Knight 1921)(Keynes 1922). As such, uncertainty is a situation in which (in the words of the celebrated probability theorist Finetti (Finetti 1974), probabilities simply "do not exist". Yet this same term 'uncertainty' is now routinely used in environmental studies, with exactly the *opposite* meaning – where political pressures discussed above nonetheless force assertion of singular representations of probabilities. Suppressing the open-endedness of colloquial ideas of uncertainty as well as clashing with the strict definition (Funtowicz & Ravetz 1990), it is this that constitutes the "pretence of knowledge" referred to above (Hayek 1978). So, it is to avoid such misleading confusions, that the term 'incertitude' can be used in a more general fashion, clearly covering all senses of the colloquial general implications of 'uncertainty'. But the point here is not about words, but whether academic or policy imaginations even acknowledge at all, a condition under which there is little confidence in any single picture of probabilities (Wynne 1992).

However, Figure 3 also shows that this is not the only reason for thinking about 'incertitude' in this general way. Even if suppression of 'uncertainty' (in a strict sense) is avoided, other

deep challenges remain. For instance, colloquial use of the word 'ambiguity' refers to a parallel dilemma, in which it is not the likelihood of different outcomes that is at issue, but even more fundamental problems around defining, measuring, partitioning or bounding the possibilities themselves (Stirling 2010). This can occur even for historical events that have already occurred (which are in this sense 'certain'), but where questions still arise over 'what happened?' In other words, ambiguity is about 'contradictory certainties' (Thompson & Warburton 1985)

Ambiguity involves many conflicts, in: interests or values; notions of 'benefit' or 'harm'; ideas about policy options. Here, it is well established in rational choice theory (the Nobel prize-winning paradigm underlying risk assessment), that there can be no guarantee in a plural society, of any single ordering of social preferences (Arrow 1963). In other words – even aside from difficulties with probabilities – the idea of calculating a uniquely optimal environmental response in 'the real world' – is not only difficult in practice… it is fundamentally impossible in principle. Under ambiguity, then, simplistically singular ideas of 'sound science' are also a seriously misleading oxymoron.

A final implication of Figure 3, is that there also exist situations in which all these dilemmas of incertitude apply together (Dovers & Handmer 1995). This is referred to in the literature as a state of 'ignorance' (Faber & Proops 1990) – a condition under which "we don't know what we don't know" (Wynne 1992), where "unknown unknowns" yield the ever-present prospect of 'surprise' (Brooks 1986). Far from being abstract, the importance of ignorance is widespread in environmental studies. In challenges like BSE, ozone depletion and endocrine disrupting chemicals (Gee et al. 2013)(Harremoës et al. 2001), for instance, the key problems were not erroneous probability distributions, but that the possibilities themselves were surprises.

It is in these ways, then, that Figure 3 highlights some key challenging-but-neglected aspects of 'incertitude'. In focusing directly and practically on implications for methods, it spans a diversity of more elaborate taxonomies of different sources and contexts for incertitude (Faber & Proops 1990)(Smith & Stern 2011)(Walker et al. 2003). For each contrasting aspect, it indicates illustrative kinds of method, which can help draw out complex implications that are often suppressed in conventional environmental policy. By encouraging the avoidance of reduction of every challenge merely to risk assessment, the resulting

general approach is more precautionary (Harremoës et al. 2001). But the point here is not to suggest that each specific instance of environmental problem can be assigned to a particular category. Instead, the framework is heuristic – aiding thinking about a wider diversity of methods beyond reductive forms of risk assessment or optimisation.

Taken together, the methods shown in Figure 3 offer ways to be more realistic about the inconvenient fact that contrasting framings (Figure 2), often lead to enormous discrepancies in environmental appraisal (Figure 1). To ignore this in governance can leave the most vulnerable people exposed to the consequences – a syndrome the social theorist Beck called "organised irresponsibility" (Beck 1992). By making greater use of these practical 'Cinderella methods' for addressing different aspects of incertitude, environmental appraisal can become more robust about specific conditions under which contrasting conclusions arise over the best policy actions. Methods can help reshape institutions. So environmental policy can hope at the same time to become more rigorous and more accountable. Instead of forcing technocratic closure of a kind that can reinforce entrenched interests, this can help open crucial space for what has so often proven essential in achieving the necessary environmental transformations: democratic struggle (Scoones et al. 2015).

Learning Resources

A classic early articulation of challenges of incertitude can be found in reference (Funtowicz & Ravetz 1990). A wealth of case studies and practical lessons are deeply analysed in references (Gee et al. 2013) and (Harremoës et al. 2001).

A website that builds on rich accumulated experience in exactly the tradition of analysis of incertitude introduced in reference (Funtowicz & Ravetz 1990), to point to a variety of practical tools for analysing different aspects of incertitude can be found here: http://www.nusap.net/

Another website that discusses broader methods likes those shown in Figure 3 for generally 'broadening out' and 'opening up' policy appraisal – with links to many other web resources – can be found at the STEPS Centre: http://steps-centre.org/methods/

A particular web-based interactive tool that practically illustrates what is meant by 'opening up' incertitude as discussed here, can be found at: http://www.sussex.ac.uk/mcm/index

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